REMARKS

Claims 1 and 3 have been amended to recite that the hard film comprises a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC. Support is found, for example at page 11, lines 12-13 in the specification.

Independent method claims 5 and 6 have been amended to include all of the limitations of amended product claims 1 and 3, respectively. If the product claims are found to be patentable, then Applicants respectfully request rejoinder of the non-elected method claims pursuant to MPEP § 821.04.

New claims 10 and 11 find support, for example, at page 11, lines 13-16 of the specification. New claims 12 and 13 find support, for example, at page 13, lines 18-22 of the specification (silicon nitride material containing sintering aids in a total amount of 3.0 wt%).

Entry of the amendments is respectfully requested.

Review and reconsideration on the merits are requested.

Claims 1-4 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,318,836 to Ito et al, or U.S. Patent 5,137,398 to Omori et al, or JP 8-12471 (JP '471). Claims 1 and 3 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,334,453 to Ito et al, or GB 2263709 (GB '709), or EP 503822 (EP '822) or JP 4-202075 (JP '075) or JP 4-136174 (JP '174).

The Examiner considered each of the cited references as disclosing a sintered silicon nitride material coated with a hard film, which substrate is said to inherently meet the claimed properties of (bending) strength, weight change associated with sintering, and distribution of grain boundary phase.

In response, claims 1 and 3 have been amended to recite that the hard film comprises a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC. The amendment distinguishes the silicon nitride member of the invention from the prior art references which disclose a diamond-coated body. Therefore, the present claims are not anticipated, and withdrawal of the foregoing rejections is respectfully requested.

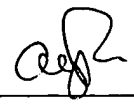
From a different perspective, in order to maintain good wear resistance and a certain level of resistance to chipping of a silicon nitride member coated with a hard film, an important consideration is to control volatilization of a grain boundary, which is formed on the surface of a substrate during sintering of the substrate, so as to establish an appropriate amount of a grain boundary phase. See, for example, page 4, lines 4-16 of the specification. The amount of the grain boundary phase is controlled, in part, by adjusting the quantity of sintering aid that is incorporated into the silicon nitride material. The present invention contemplates a lower grain boundary phase content to improve wear resistance.

Applicants dispute that the silicon nitride members of the cited references exhibit each of the claimed properties (bending) strength, weight change associated with sintering, and distribution of grain boundary phase. However, to advance prosecution, Applicants define over the prior art based on the hard film.

Allowance of claims 1 to 13 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) A silicon nitride member comprising a substrate formed by sintering a silicon nitride material, and a hard film comprising a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC formed on a surface of said substrate, said silicon nitride member characterized in that:

when the strength of said substrate measured before said substrate is coated with said hard film is taken as 100%, the strength of said silicon nitride member measured after said substrate is coated with said hard film is 70% to 95%.

3. (Amended) A silicon nitride member comprising a substrate formed by sintering of a silicon nitride material, and a hard film comprising a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC formed on a surface of said substrate, said silicon nitride member characterized in that:

when the amount of a grain boundary phase as measured at a central portion of said substrate is taken as 100% by volume, at least one of the following conditions (1) to (5) is satisfied:

(1) the amount of a grain boundary phase as measured in the vicinity of a depth of 100 μm from the surface of said substrate is less than 30% by volume;

(2) the amount of a grain boundary phase as measured in the vicinity of a depth of 200 μm from the surface of said substrate is 30% to 50% by volume;

(3) the amount of a grain boundary phase as measured in the vicinity of a depth of 300 μm from the surface of said substrate is 50% to 70% by volume;

(4) the amount of a grain boundary phase as measured in the vicinity of a depth of 400 μm from the surface of said substrate is 70% to 85% by volume; and

(5) the amount of a grain boundary phase as measured in the vicinity of a depth of 500 μm from the surface of said substrate is 85% to 100% by volume.

5. (Amended) A method, for manufacturing a silicon nitride member [as claimed in claim 1] comprising a substrate formed by sintering a silicon nitride material, and a hard film comprising a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC formed on a surface of said substrate, said silicon nitride member characterized in that:

when the strength of said substrate measured before said substrate is coated with said hard film is taken as 100%, the strength of said silicon nitride member measured after said substrate is coated with said hard film is 70% to 95%, which method comprises:

adjusting a condition employed in sintering said substrate such that a change in weight of the substrate associated with sintering is 1.5% to 3.5% by weight.

6. (Amended) A method, for manufacturing a silicon nitride member [as claimed in claim 3] comprising a substrate formed by sintering of a silicon nitride material, and a hard

film comprising a hard component selected from the group consisting of Al_2O_3, TiCN, TiN and TiC formed on a surface of said substrate, said silicon nitride member characterized in that:

when the amount of a grain boundary phase as measured at a central portion of said substrate is taken as 100% by volume, at least one of the following conditions (1) to (5) is satisfied:

(1) the amount of a grain boundary phase as measured in the vicinity of a depth of 100 μm from the surface of said substrate is less than 30% by volume;

(2) the amount of a grain boundary phase as measured in the vicinity of a depth of 200 μm from the surface of said substrate is 30% to 50% by volume;

(3) the amount of a grain boundary phase as measured in the vicinity of a depth of 300 μm from the surface of said substrate is 50% to 70% by volume;

(4) the amount of a grain boundary phase as measured in the vicinity of a depth of 400 μm from the surface of said substrate is 70% to 85% by volume; and

(5) the amount of a grain boundary phase as measured in the vicinity of a depth of 500 μm from the surface of said substrate is 85% to 100% by volume, which method comprises:

adjusting a condition employed in sintering said substrate such that a change in weight of the substrate associated with sintering is 1.5% to 3.5% by weight.

8. (Amended) A cutting tool formed of [a] the silicon nitride member as claimed in claim 1.

9. (Amended) A cutting tool formed of [a] the silicon nitride member as claimed in claim 3.

Claims 10-13 are added as new claims.